MICROWAVE THERMAL EMISSION MAPPING OF THE STEALTH REGION ON MARS. Anton B. Ivanov, Duane O. Muhleman, Ashwin R. Vasavada, *170-25, California Institute Of Technology, Pasadena, CA, 91125, USA, anton@mola.gps.caltech.edu* .

We observed Mars with the Very Large Array (VLA) on two nights during oppositions in December 1990 and February 1995. Operating at the wavelength of 1.35 cm (22 GHz), we were able to map brightness temperatures of the Martian surface. Our observations were taken during northern spring ($L_s = 60$) and northern winter ($L_s = 352$) of Mars.

The major goal of these observations was to look at Stealth. This feature was discovered on Mars by Muhleman's radar group in bistatic Goldstone/VLA experiment [1]. The most striking property of this feature is that no measurable echo was detected from it, in this and the following experiments [2]. Stealth is interpreted as a medium, free of rocks and clamps of centimeter size and larger that would act as subsurface scatterers. Nothing like this exists on the Earth or is known to exist on the terrestrial planets or the Moon. Stealth lies west of Tharsis ridge. It is roughly bounded between 140W and 160W longitudes and 7S and 3N latitudes.

The VLA is a huge interferometer, which consists of 351 single interferometers formed by its 27 antennas. We used AIPS (Astronomical Images Processing System) to obtain a series of 14 maps of Mars microwave brightness temperature. Maps were made with intervals of 23 minutes (1995 data) and 35 minutes (1990 data). AIPS is a standard NRAO package for calibration and reduction of the data.

The observed temperature variations were compared with model temperature variations as a function of solar time at the surface. Model temperatures were obtained by solving the 1D thermal diffusion equation and then integrating the radiative transfer equation. To estimate properties of the subsurface layer, emissivity of the medium was varied as a parameter to match measured surface brightness temperature variations. The effective probing depth for the passive emission is only several wavelengths, which is even shallower than radar studies. However, this allowed us to estimate some radiophysical properties of the top 10-15 cm of Martian soil. Resulting maps display region of comparatively high emissivity (near unity) and, hence, of low density. It spreads between 5S and 5N and between 135W and 147 W. This is right inside the Stealth region as described in [3]. The highest value of emissivity in this region is $0.995^{+0.004}_{-0.007}$ and this is an equator point at 147N. This value of emissivity corresponds to density of 0.4 ± 0.2 gm cm^{-3}, averaged over a depth of many wavelengths.

The geological map by Scott and Tanaka [4] identifies the area of Stealth as covered with ash flows or thick eolian deposits (*Amm* and *Amu* units). These units are dated as the youngest (Late Amazonian) geological features on Mars. On the other hand, combined analysis of active and passive radar data shows that this region is formed by some underdense material like ash or pumice and is associated with the nearby Tharsis volcanoes. Hence, the origin of Stealth might be associated with activity of Tharsis volcanoes during the Late Amazonian period.

References

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[4] Scott D.H. and Tanaka K.L. Geological map of the western equatorial region of Mars. *USGS Map, I-1-1802A*, 1986.